

Résumé de thèse*

Phylogenetic relationships of otophysan (Actinopterygii, Teleostei), notably the Characiformes, including fossil members, by Diogo de MAYRINCK (1).

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The clade Otophysi is nowadays present on all continents with the exception of Antarctic. Some extant taxa inhabit the marine and coastal waters, but most of the diversity is in freshwater habitats. Indeed this largely diversified group represents 75% of ichthyological diversity of the continental freshwaters. It gathers four monophyletic orders, i.e., Characiformes, Siluriformes, Gymnotiformes and Cypriniformes.

Until the late 70's, the most ancient confirmed record of an otophysan fish was a fish collected in freshwater deposits dated from Miocene (23-5 Ma) and the interrelationships between the four orders Characiformes, Siluriformes, Gymnotiformes and Cypriniformes were considered resolved. These ideas prevailed until the discovery of fossil fishes from marine Cretaceous deposits from Europe, Africa and South America. These Mesozoic fishes were long thought to be stem Characiformes or Cypriniformes. The knowledge of their marine habitat leads to debate about the probable original habitat, either marine or freshwater, for this dominantly freshwater clade. Moreover, if the fossils species described share anatomical characters with the modern taxa, some of the observed character states and their distribution among these ancient forms show weakness in the phylogeny that prevailed. Finally, the debates generated by these fossil findings suffered a lack of consensus between authors in the interpretation of certain skeletal structures observed on the fossils themselves. So far, only the monophyly of the clade Otophysi remained undisputed. The monophyletic condition is supported morphologically, notably on the basis of osteological features, i.e., a peculiar ethmo-vomerian region configuration, the presence of a Weberian apparatus (modifications of the first occipital vertebrae creating an anatomical complex responsible for transmitting vibrations from the gasbladder to the inner ear), and the presence of a compound terminal centrum (fusion between the preural 1 centrum, the ural 1 centrum, the neural arch of the preural 1 centrum, the uroneural 1, the parhypural, and the hypural 2).

This thesis aims to enhance our understanding of the interrelationships within Otophysi, principally through the study of the evolution of osteological characters of both extant and fossil taxa. A peculiar interest was given to the bony structures that appear to bear

phylogenetic information, notably the Weberian apparatus, the ethmo-vomerian region and the caudal skeleton. The anatomy of most of the fossils attributed to Otophysi *incertae sedis* or considered as stem taxa in one of the four orders is revised. The fossils concerned are †*Santanichthys diasii*, †*Lusitanichthys characiformis*, †*Lusitanichthys africanus*, †*Chanoides macropoma*, †*Chanoides weberi*, †*Chanoides chardonii*, †*Salminops ibericus* and †*Sorbinicharax verreaesi*. So, through the anatomical review of these fossils, I revised the characters that classically support the phylogenetical hypotheses for Otophysi. Then, fossils were included in a phylogenetic analysis, along with modern species from each of the orders of Otophysi, in order to discuss their relative positions in the otophysan clade. The data matrix is compound by 90 characters.

The main results are as follow. Certain anatomical details of the skeleton of the fossil species revised are described for the first time or interpreted in a new way. This anatomical review leads to exclude certain fossils from the clade Otophysi, for instance, †*Salminops ibericus* and †*Sorbinicharax verreaesi*. In that case, the bones described like Weberian ossicles do not belong to such a complex structure, which is indeed absent in all the specimens available that were attributed to these fossils species. Conversely, the inclusion of †*Lusitanichthys*, †*Chanoides*, and †*Santanichthys* within the clade Otophysi is confirmed. The parsimony analysis leads to new assumed position within the Otophysan for these fossil forms: it supports the monophyly of the genus †*Lusitanichthys*; it questions the monophyly of the genus †*Chanoides*; it shows that †*Salminops* and †*Sorbinicharax* are probably sister taxa; and finally it indicates that †*Santanichthys* is the sister group of the clade formed by three of the four orders extant (Siluriformes, Characiformes and Gymnotiformes). Moreover, the phylogenetical analysis shows that the inclusion of the fossil taxa in the data matrix affects the stoutness of the clade Otophysi.

Better understanding the evolution of the great Otophysan fish clade would feed on new data to better interpret the anatomical structures showed in the modern and also in the fossil taxa, notably the two bony complexes that are the Weberian apparatus and the ethmo-vomerian region.

Key words. - Eocene - Cretaceous - Anatomy - Otophysi - Phylogenetic systematics - Evolution.

* A pdf of this PhD thesis is available at: <http://www.mnhn.fr/sfi/sfi/8.theses/8.theses.html>

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